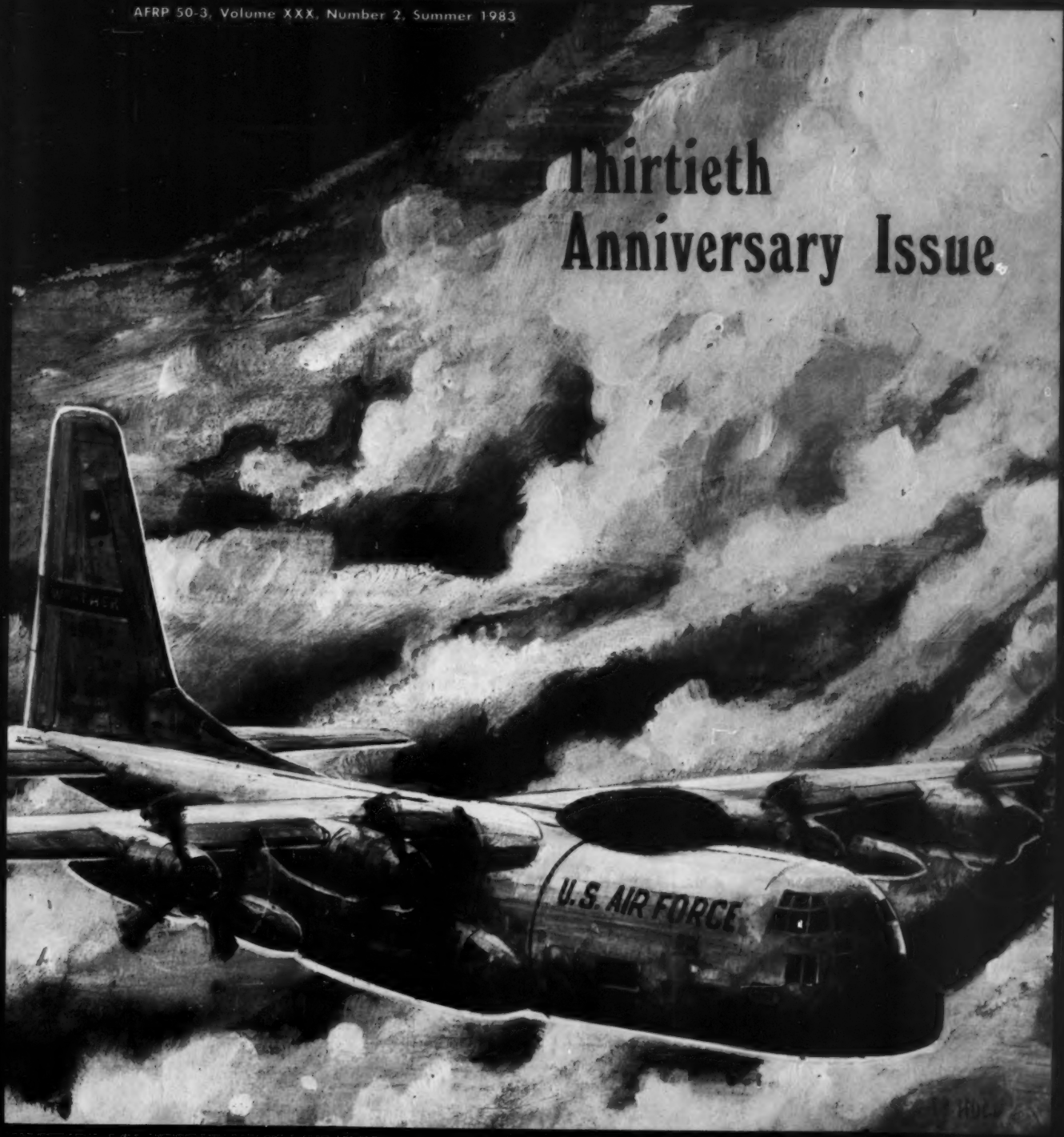
THE NAVIGATOR

AFRP 50-3, Volume XXX, Number 2, Summer 1983

Thirtieth Anniversary Issue



30 years

Congratulatory Messages

CHIEF OF STAFF
UNITED STATES AIR FORCE
WASHINGTON

13 JAN 1983

Dear Captain Smith

Congratulations to all who have worked over the past 30 years in making THE NAVIGATOR such an excellent magazine.

With today's rapid advances in technology, it's imperative that the men and women who operate and control our advanced systems achieve the highest levels of proficiency. In this regard, THE NAVIGATOR has served as an outstanding professional forum, providing information and continuing education to a vital part of the Air Force team. All who have served with the magazine can be proud of their contributions to our mission readiness.

Sincerely

CHARLES A. GABRIEL, General, USAF
Chief of Staff

Captain William C. Smith, USAF
Editor, THE NAVIGATOR Magazine
323d Flying Training Wing
Mather AFB, California 95655

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS ELECTRONIC SECURITY COMMAND
SAN ANTONIO, TEXAS 78243

Captain William C. Smith
Editor, THE NAVIGATOR Magazine
323d Flying Training Wing
Mather AFB, CA 95655

10 MAY 1983

Dear Captain Smith

My heartiest congratulations to THE NAVIGATOR on its anniversary edition.

For 30 years this magazine has provided its readership with superb examples of professionalism and the latest in technical developments. These quality contributions continue to enhance the proficiency and operational effectiveness of Air Force navigators.

Furthermore, the constant and dedicated vigil this publication has given to our vocation assures that prospective trainees will have a strong background to draw upon.

Thank you for this opportunity to express my personal comments about a magazine that has been a contributing influence for a strong United States Air Force.

Best wishes for continued success.

Warm regard

DOYLE E. LARSON
Major General, USAF
Commander

ROBERT E. SADLER
Major General USAF (Ret.)

27 April 1983

Captain Bill Smith
Editor, Navigator
323 FTW/PS
Mather AFB, CA 95655

Congratulations to the Navigator and its Staff on their 30th Anniversary.

Thirty years is a full tour of duty; and most navigators that read the first issue are retired. However, I'm sure that they all remember the beginning. The Navigator served them all well throughout their careers. It took them from the B-29 to the B-1 and the C-54 to the C-5; and it helped the GIB and the crow grow.

The first issue was published as the Aircraft Observer by the 3300th Training Publication Squadron in St. Louis, Missouri. The 3300th was an unusual outfit -- it was a navigator organization. Joe Sage, the first Editor, was a Bombardier; and Sherwood Lapping, John Mulligan, Bill Minnick and Mike Nisos had all been instructors at Mather during the Aerial Observer Bombardment (AOB) days. Besides this group of expert navigators, Joe was supported by other talent as well. We had an excellent group of illustrators headed by Bob Smith who recently retired as the Art Director at Mobile Oil; and at the publisher putting everything together was a young aviation artist by the name of Keith Ferris who was just starting his career. Keith is now the Chairman of the Air Force Art Committee for the Society of Illustrators and one of the leading aviation artists in the country.

The primary mission of the 3300th was to "write the books" for all navigators. You may remember some of them -- Air Navigation (AFM 51-40), Bombs and Bombing Systems, Bomb Racks and Controls, Radar Target Intelligence, Radar Scope Photography, Shoran Bombing, Weather for Aircrew Trainees, In-Flight Maintenance of the AN/APQ-24, How to Operate the AN/APQ-24, In-Flight Maintenance of the K-Systems, The B-36 Observer's Manual, and many others.

FROM THE EDITOR

In Defense of Optimism

"It is better to fight for the good, than to rail at the ill."
Tennyson

With this issue we celebrate 30 years of service. It is difficult for me to reflect upon this publication's beginnings, since they barely followed on the heels of my own.

Since our last issue, we've been receiving and reading our survey feedback. Thanks to those of you who took the time to respond. Regrettably, we can't answer every comment, but we'll do our best to solicit the articles you want.

Most of you sent praise and constructive criticism. However, some suggested that we often paint too rosy a picture of the Air Force navigator's career. You proposed that we tell it more like it is—include the bad news for navigators along with the good. That is not our job.

This publication began 30 years ago as a professional journal dedicated to promoting the welfare and improvement of every navigator's lot. With that responsibility goes an obligation to create and preserve a positive professional image. Sure, we could serve narrow interests by pointing a finger at shortcomings—many like the obstacles every professional faces during a long career. But that only sullies our image. THE NAVIGATOR has survived for 30 years primarily because it has not stooped to muckraking.

It would be wonderful if every navigator could be a DO or squadron commander. It would be glorious if all of us could earn the rank of colonel or general. Those who are driven, determined, and adequately prepared, can attain any of these goals. If you say the odds are long, then you overlook the fact that you have the most influence on those odds. The key is hard work.

The Air Force navigator's life is not a bed of roses. That was never promised. But THE NAVIGATOR refuses to "rail at the ill." We find our challenge and gratification in fighting for and promoting the good.

The Navigator was Joe Sage's idea. It was taking us too long to get new techniques and ideas into practice. Given, for example, that Air Navigation was outdated when you decided it needed revision, it was at least a year and a half job to plan a revision, write it, coordinate it, publish and distribute it. Joe felt that we needed another faster medium. His idea is now the Navigator. He developed it and sold it; but it wasn't easy.

In 1953, the budget was taking big cuts; and the Air Force didn't think they needed another periodical. So they turned Joe's idea down -- temporarily. Joe packed his bags and took off for Washington with the paste-up and artwork for the first issue as well as the articles for the next two issues. He came back a winner because he had one.

Joe sold the Navigator on its quality and the demonstrated fact that it would meet a professional need. That's what has kept it going and what will keep it going for the next 30 years. But the Navigator staff can't do it alone. They need the professional contributions of every "hot shot." It gives each of you the opportunity to propagate the faith -- to make a contribution to your heritage. Give it a try so we can all sign up for a copy of the Silver Anniversary Issue.

Congratulations again and best wishes to all navigators for continued success.

Robert E. Sadler
Robert E. Sadler
Major General USAF (Ret)

RES:ch

THE NAVIGATOR

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Published triannually with funds approved by Headquarters, United States Air Force. Distributed through the Air Force Publication Distribution Center in accordance with Air Force Regulations.

Manuscript contributions are welcomed, as are comments and criticisms. Contact the Editor at the address below or at (916) 364-2138 or AUTOVON 828-2138 before extracting from or reprinting material. Opinions expressed by individual contributors do not necessarily reflect the official viewpoint of the Department of the Air Force.

Address manuscripts to Editor, THE NAVIGATOR magazine, 323 FTW/PS, Mather AFB CA 95655. Address subscriptions to Superintendent of Documents, GPO, Washington, DC 20402; yearly $8.50 domestic, $10.65 foreign; single copy $3.75 domestic, $4.70 foreign. Air Force Recurring Publication 50-3.

Authority to publish this periodical automatically expires on 31 October 1983 unless continuance is authorized by the approving authority prior to that date.

AFRP 50-3

Our cover painting depicts a WC-130 from the 54th Weather Reconnaissance Squadron, Guam. The 54th's "Typhoon Chasers" observe and investigate Pacific storms. Read their story beginning on the next page.

If aerial refueling is part of your mission, you'll find useful techniques in a pair of articles starting on page 11.

TYPHOON CHASERS

Major Benjamin C. PITTMAN
AF/MPE
The Pentagon

1730Z "Pilot, Nav. Radar shows a strong feederband of thunderstorms at 50 nautical miles. Slow to penetration airspeed. I'll give headings to steer us through."
1745Z "Weather, Nav. I have the 'eye' on radar at 75 miles. The eye-wall appears to be about five miles wide."
1800Z "Crew, Nav. We'll be penetrating the eye-wall in approximately five minutes. Make sure you're strapped in and all loose equipment is stowed."

Most C-130 navigators are judged by how well they avoid severe weather, but a few of us earn our pay by flying through it. Skirting thunderstorms and punching through typhoons is merely part of the job for the men and women of the 54th Weather Reconnaissance Squadron (WRS) at Andersen AFB, Guam. Our aircrews locate and measure tropical storms and typhoons to provide early warning for United States resources throughout the Pacific. From Clark to Yokota, the WC-130s and crews, using the "Swan" call sign, are affectionately known as the "typhoon chasers."

The 54th Weather Reconnaissance Squadron's history dates back to 1944 when it was known as the 654th Bombardment Squadron, assigned to the Eighth Air Force, Norfolk, England. The 654th's mission was largely prebombardment target survey, but they did fly some weather reconnaissance for other bomber squadrons. Over the years, the squadron moved from the United States to overseas locations, then back again, and flew a variety of airframes including B-25, B-26, TB-29, WB-29, C-47, and WB-50 aircraft. By 1962, the 54th had reorganized at Andersen AFB and reequipped with WB-47s. The squadron converted to WC-130 aircraft in 1965 and, in 1975, became part of the Aerospace Rescue and Recovery Service, under the 41st Rescue and Weather Reconnaissance Wing, McClellan AFB, California.

The 54th's mission is to provide weather reconnaissance, air sampling, and specialized reconnaissance support for atmospheric research. Our global mission area covers seven million square miles of the Pacific Ocean. We fly weather tracks for fighter deployments and, occasionally, we're tabbed for search and rescue missions to aid the numerous surface craft that become stranded on the high seas. Additionally, the 54th conducts an extensive humanitarian goodwill effort called "Christmas Drop." Annually, hundreds of boxes containing food, clothing, supplies, and toys are air-dropped to needy villagers on nearby islands. Christmas Drop is certainly one of our most satisfying missions, and it gives us a chance to experience tactical flying. All of these missions are important and make a weather tour rewarding, but flying into typhoons really makes our job special, as you'll soon discover.

A WC-130 crew consists of an aircraft commander, copilot, navigator, weather officer, engineer, and dropsonde operator. When flying a storm, the pilot and engineer stay busy monitoring systems, managing fuel consumption, and maintaining storm penetration airspeed. The navigator, aerial reconnaissance weather officer

A 9th Weather Recon Gp WB-47

(ARWO), and the dropsonde operator (Drop), form the hub of the weather data-collecting team. As in any aircraft, mission success depends on a total crew effort. The ARWO is mission director. Navigation is critical, with success of the entire mission hinging on the timeliness and accuracy of the navigator's work.

Basic navigation is the typhoon chaser's forte. The navigator's equipment includes Doppler, Loran C, and Omega; however, flying the Pacific requires well-developed dead reckoning skills. The Loran and Omega are degraded by periods of twilight and the actual storm environment we operate in, so the navigator must have other means of fixing the aircraft's position. During the non-storm season, we brush up on pressure-pattern and celestial—they are hard to practice in and around typhoons. Fifty percent of the 54th's navigators are grid qualified. Our grid procedures, however, are very simple when compared with those of other commands. For a young navigator, the 54th is one of the best initial assignments to develop and refine basic navigation skills. If I were to choose a Navigation Procedures instructor for Mather, you can bet I would grab a navigator from the 54th.

No weather phenomenon is more awesome than the typhoon—or hurricane if you're east of the International Date Line. From January through June, the typhoon breeding ground, east of Guam, comes alive as thunderstorms gather from a combination of warm ocean currents and low-level winds. Disturbances build vertically and move westward with counterclockwise winds (typhoons form around low pressure centers). These weather systems continue gathering strength, with full-blown typhoons developing in as little as 48 hours. The Joint Typhoon Warning Center (JTWC), located on Guam, usually detects disturbances via satellite as soon as they start to form. Only our aircraft, however, can supply JTWC with the specific information needed to issue warnings to naval fleets and military bases. At first sighting, the 54th usually is tasked to investigate the storm area and determine counterclockwise wind movement in each quadrant. Investigative missions are flown at 1,500 feet within a 250 nm area around the center of the disturbance. If the crew measures fully circular winds, JTWC then requires 10,000 foot storm fixes every 12 hours, usually at first-light and last-light.

Flight planning for a storm mission is a little unusual—and rightly so. When JTWC informs the 54th of the projected coordinates of the tropical storm or typhoon, the navigator plots a 250 nm circle around the spot. An altitude reservation is then requested. Center blocks the area from the surface to 10,000 feet. The remaining flight plan is backed up from the 250 nm circle to Andersen (Clark, Kadena, or Yokota, if we're deployed).

Aircrew predeparture tasks are standard, except for our weather briefing which is obviously more detailed than a standard aircrew brief. Our enroute altitude is usually 18,000 feet (the 500 millibar level). That is where optimum steering winds (the winds that drive the weather system) are located. After reaching the storm area, we descend to 10,000 feet inside the 250 nm circle. Descending to 10,000 feet (700 millibars), inside the system, provides more exposure to the stronger bottom quarter of the storm and offers the ARWO a definitive level for instrument calibration. Additionally, flying at this level keeps the aircraft relatively safe from lightning strikes which could be encountered near or above the freezing level (about 15,000 feet). While inside the mission airspace, the navigator directs the aircraft around storm cells ("feeder bands") until 150 nm from the storm's center. Navigating the middle 150 miles demands total crew coordination.

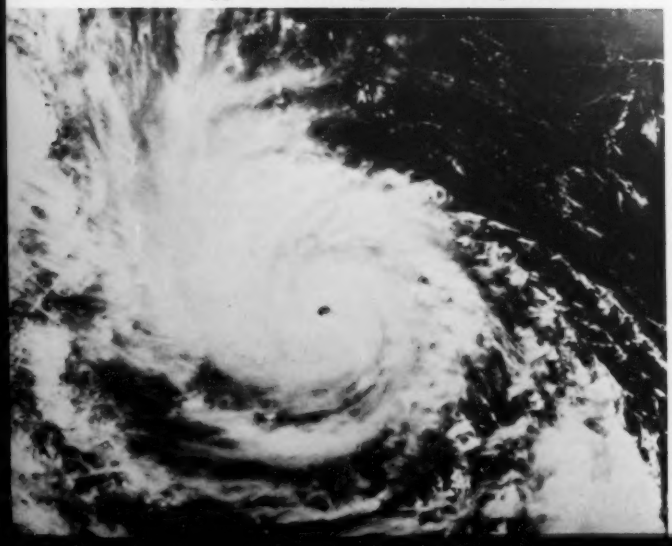
The typhoon's eye normally paints on radar at 50 nm range. It appears as a no-show area,

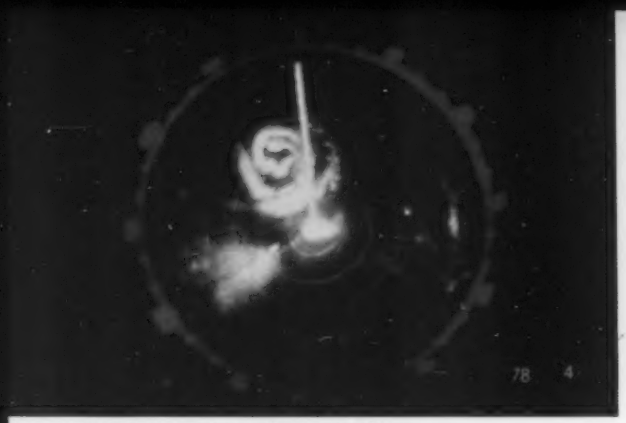
TROPICAL CYCLONE CLASSIFICATION

NAME	MAXIMUM SUSTAINED SURFACE WIND SPEED
Tropical Depression	Less than 34 knots
Tropical Storm	34 to 63 knots
Typhoon (Hurricane)	More than 63 knots
Super Typhoon	Greater than or equal to 130 knots

Figure 1

This 1981 satellite photo of super Typhoon Elsie shows typical storm system development.





Airborne radar paints a typhoon.

usually 5-20 miles wide, surrounded by a bright "eye wall" which is 5-10 miles wide. Generally circular in shape, the eye extends from the surface to about 50,000 feet. The ride through the storm wall is usually brief, but occasionally the penetration can send a nav bag to the ceiling and keep it there. Such jolts are rare. Light to moderate turbulence is more the norm.

After punching through the eye-wall, the navigator, ARWO, and Drop begin gathering and recording storm data. The ARWO evaluates both the 10,000-foot level and surface center—the two normally are not collocated. The distance between them is a good indication of storm strength and direction. The navigator provides most of the data for the 10,000 foot fix, while the ARWO uses weather "magic" to determine the surface center. The nav then plots both positions with Loran and Omega. At the surface center, the Drop releases a "sonde" (a tubular electronic sounding device) into the water to record temperature, atmospheric pressure, and humidity. We then orbit while the ARWO and Drop transmit their information to JTWC via HF radio.

Next comes the fun. After all of the data for JTWC's warning message is relayed, we penetrate the eye-wall, fly the peripheral track shown in Fig 2, and then turn around to do it again. On a typical mission we go through the eye-wall four times and

Operation Christmas Drop—A Tradition in the Pacific

It all began during Christmas season 1952 when a WB-29 weather aircraft from Guam circled the tiny island of Kapingamarangi following a routine reconnaissance mission. Suddenly the crew spotted groups of waving villagers. Struck by a surge of holiday spirit, they gathered items on board, including flight lunches, and dropped the gifts to the islanders. With that generous act, Christmas Drop was born. Now, each Christmas season, the men and women of the 54th Weather Reconnaissance Squadron (WRS) Andersen AFB, Guam, sponsor this humanitarian effort that brings tons of supplies to the residents of atolls and islands in the Caroline, Marshall, and Mariana chains.

Since that first charitable gesture, Christmas Drop has grown significantly in scope with both military and civilian residents of Guam contributing. The massive effort encompasses collecting, sorting, and packing hundreds of pounds of clothing, tools, toys, fishing equipment, batteries, books, flashlights, medical supplies and other items that make life better for the isolated islanders. The 54 WRS spearheads the sorting and packing, then attaches the bundles to parachutes. The effort climaxes as WC-130 aircrews drop the Christmas packages.

Christmas Drop '82 was an overwhelming success. Sixty boxes containing over 12,000 pounds of goods were airdropped to 20 islands surrounding Guam. Each mission took about ten hours with a lot of low-level flying. To the "Typhoon Chasers," Christmas Drop is a most rewarding effort. Effective training takes place, but it's the humanitarian goodwill to our Pacific neighbors that makes Christmas Drop a terrific holiday event.

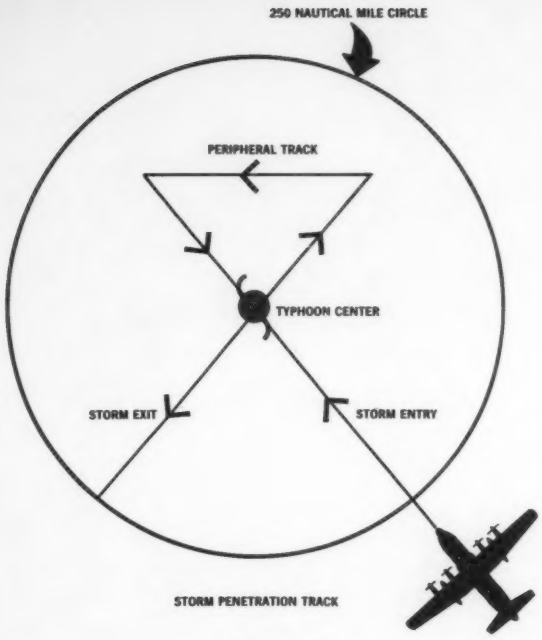


Figure 2

log two penetrations. Fifteen storm penetrations qualify a crew member for an Air Medal. Last year the 54th logged 293 penetrations while "flying" 29 typhoons.

Storm season is brief and busy, lasting only from June through December. During the "dry" season, we concentrate on upgrade and continuation training as well as the paperwork business. Most importantly, we get reacquainted with our families. An active storm season might require 10-15 days of TDY per month. Most trips last only five days and take us to some ideal shopping spots (Clark, Kadena, and Yokota).

For a young navigator, the 54 WRS is the best flying assignment in the Air Force. You can gain tremendous experience in a short time, log an impressive number of hours, enjoy good TDY and, since we're detached from our parent wing, find opportunities for many varied staff positions. Recently, a lieutenant upgraded to instructor with 800 total hours, excelled at a staff job in the plans shop, assumed the assistant executive officer position, and received a squadron nomination for company grade officer of the quarter. All of that occurred in just 18 months with the 54th.

You'll probably agree that duty with the 54 WRS offers excellent opportunities. When you read this, I will have left the weather mission for the Air Staff—still, I'm one of its staunchest supporters. Those in the 54th work hard to sustain the Aerospace Rescue and Recovery Service motto, "That others may live." If you'd like to know more about this rewarding assignment, contact MPC or any of the 54th navigators. To call the 54th, dial AUTOVON 332-4154. Join the chase.

Maj Pittman was commissioned through ROTC at Clemson University in 1968 and later earned a master's degree from Troy State University. After UNT and NBT, he was assigned to the B-52H at Wurtsmith AFB. He served a SEA tour before duty at Blytheville AFB and then Hurlburt Field, followed by instructor duty at the USAF Academy. Maj Pittman now is assigned to HQ USAF.

3.00" FULL SIZE
NOTES
BADGE TO BE MADE OF 92.5% FINE SILVER, OXIDIZED.
PIN STEMS, HINGES & CATCHES TO BE MADE OF NICKEL SILVER, SILVER PLATED.
PIN STEMS TO BE 2.50" LONG.
HINGES TO BE THE FLAT JOINT TYPE.
& CATCHES TO BE THE BALL SHAPED SAFETY TYPE.
& CATCHES TO BE SOLDERED TO BADGES WITH SILVER SOLDER.
AIRCRAFT OBSERVER BADGE

OR WINGS

First Lieutenant Michael R. LITTLE
38 SRS
Offutt AFB, NE

Have you ever wondered where the design for your navigator wings originated? It may have been the last thing on your mind when they first were pinned on, but you're likely to have thought about those wings often during navigator training or an assignment that followed. Perhaps you even despaired of ever wearing them yourself. The history of your wings is an interesting story and makes their significance more complete.

While researching the background of the navigator badge, I digressed into the history of the navigator rating itself. The need for a second crew member, in many types of aircraft, was recognized even before World War I. Monte Duane Wright, in his book *Most Probable Position,* relates: Leutnant Hans Steffen of the Imperial German Air Service felt that "Finding the way is greatly facilitated" with the aid of another crew member, "for the passenger has more leisure to examine the maps and observe the country than the pilot." Gustav Hamel, despite his name a great prewar British pilot, said of celestial navigation that "...the driver of the aeroplane has all he can do to manage his machine, without peeping through little telescopes, twiddling mirrors, and reading scales."

One immediate problem of designating a second crew member was what to name this new breed of aviator. The aforementioned Leutnant Steffen favored the term *fuhrer* (leader), but settled for *beobachter* (observer) instead. Russian aviators adopted the term *shturman*, meaning steersman, or more properly, marine pilot, while Britain and the U.S. opted for observer. France also used *observateur* (observer), but preceded almost everyone else by using the title of *navigateur* as well.

An interesting sidelight to the early navigators' status is again recalled from *Most Probable Position*. Wright states that "...during World War I, the Germans relied extensively on noncommissioned pilots to chauffeur commissioned officers who navigated, observed the battlefield, threw bombs overboard, and manned flexible machine guns." The infamous Red Baron, Manfred Von Richthofen, began his career as an officer beobachter, serving on both the eastern and western fronts before entering pilot training.

As for the development of our wings, the first observer badge was a hand-me-down from the Junior Military Aviator—an early pilot rating. It consisted of the American shield, with a wing on the right side, embroidered in silver bullion on dark blue cloth. The badge was first authorized in October of 1917. In December of the same year, the shield was replaced with an "O", which brought the device more in line with British badges of the era. Maj Gen Norris Harbold (USAF Ret), in his book *The Log of Air Navigation*, recalls that the "original aircraft observer badge instituted in World War I was the flying O. The RAF had a most descriptive term for it..."which, for the sake of good taste, he doesn't mention. A year later, this wing was being made of all metal with a gold "US" added to its center. In January 1919, the design was again modified slightly and a new version, with wings on both sides, was authorized for the observer (qualified as pilot). In October 1921, the gold "US" was removed from the badge's center.

Observer (Oct 1917)

Observer (Dec 1917)

Observer (Dec 1918)

Aircraft Observer

By November 1941, the observer title was changed to Combat (Aircraft) Observer, and a new badge was authorized for the Technical Observer, which consisted of a capital "T" superimposed over the old "O." Interestingly, at this time, air navigation, even celestial fixing, was not the exclusive province of the observer, As General Harbold also points out, prior to World War II, most navigators were rated pilots. There was no distinctive badge solely for the navigator. In fact, there was no pure navigator rating. Pilots and observers were trained and awarded a "Certificate of Proficiency" in dead reckoning or celestial navigation. Bombardiers were another group with no genuine specialty rating. For bomber crews, the Air Corps goal was to train each flier to perform the job of any other crew member, should the need

Technical Observer

arise. As an aside, consider the fact that a commission was not required for a pilot's rating. This produced the peculiar situation of enlisted pilots serving with officer gunners, although generally not on the same aircraft.

This broad approach to specialty qualifications allowed the Army Air Force to enter World War II with a number of dual and even triple-qualified aircrew members. Unfortunately, limited training time and other constraints made continued production of multiple-qualified personnel impossible. An era of increased specialization followed.

In September 1942, seven new ratings were authorized, three of which relate to our present day navigator roles. With them, new wings were designed. Of special interest to us are the ratings and badges of the bombardier, navigator and senior observer.

The navigator badge is of particular interest because it was the first one awarded exclusively to navigators. Its centerpiece was an armillary sphere—an ancient device used to locate the position of celestial bodies for navigational, astronomical, and astrological observations. This badge was issued to qualified navigators until its discontinuance in March 1953. The armillary sphere still lives on, however, in the navigator candidate wings of AFROTC cadets.

Navigator

AFROTC Navigator Candidate

The rating and wings of the bombardier had an even shorter service life, being discontinued in July 1946. An interesting sidelight, though, is a special badge authorized temporarily during WWII for "Outstanding Distinguished Aerial Bomber for the Year." It consisted of the bombardier's bomb-on-target device surrounded by a laurel wreath and suspended from a cloud-shaped bar. Made of gold-colored metal, it was similar to badges still issued for pistol and rifle marksmanship.

Bombardier

Incidentally, if you've wondered about the symbolic meaning of the design at the center of your wings, here's an explanation.

The device is the USAF shield, crossed at the bottom by a wavy line signifying the separation of earth and sky. The shield's top section encloses several heraldic thunderbolts which depict the navigator's aerial striking power. The design embodies a symbolic challenge, for all navigators, to defend against any enemy seeking to destroy our nation.

The "Senior Observer" rating was the first application of "seniority" to an observer title and the first time a star was added to an observer wing. The change was short-lived, however, since the observer wing was discontinued along with that of the bombardier.

By the late 1940s the observer's badge was viewed as dated and needing redesign. In 1949, an Air Force-wide contest was held to select the new wing. Entries ranged from wildly flamboyant to thoughtfully symbolic, often featuring the elements of the old bombardier, navigator, and observer badges in various combinations. One surprisingly common element in many of the entries, a diving eagle clutching a bomb, seems to have come from the logo of the Aircraft, Observer, Bombardment (AOB-1037) training program, which was conducted at Mather in the late 1940s.

According to legend, the winning badge design was created by a staff officer who took a pencil rubbing from a button on his service jacket and sketched in wings on both sides. Whether that story be fact or fiction, it remains that the winged Air Force shield became the standard observer badge in 1950. Thus, this design evolved as the first distinctly Air Force aviation badge, continuing a precedent established by the Army Air Service pilot's wing designed around the American shield during World War I.

In 1953, the senior observer rating was reinstated and a star was added to the still-new badge to identify those holding this rating. In that

same year, the old navigator wing was discontinued and the observer wing issued instead. In 1957, a shift in terminology occurred and "navigator" became the basic rating. The career field is still often identified as navigator observer and the rating of observer itself, though no longer awarded, is still considered active. Finally, in 1961, the Master Navigator rating, equivalent to that of Command Pilot, was instituted and a wreath added to the star. With the relatively recent change to Title 10, authorizing navigators to command flying organizations, there may be interest in creating a Command Navigator rating. Perhaps one day.....

In 1981, Lt Little graduated from Embry-Riddle Aeronautical University. He completed UNT in 1982. Lt Little is currently an RC-135 strategic reconnaissance navigator.

the VOR alternate rendezvous

Captain Dale A. SMITH
28 AREFS
Ellsworth AFB, SD

The reasons and means for aerial rendezvous are as old as aviation itself. Some methods are better than others, and the good ones sometimes become undesirable during adverse weather conditions.

At present, we who refuel other aircraft as a livelihood are well versed in how to perform in-flight rendezvous. With all of our sophisticated equipment, however, we are often taxed when we must rendezvous and avoid thunderstorms at the same time. Directives state that safety, including thunderstorm avoidance, is paramount. Still, our mission requires successful refueling, even when weather complicates the task.

These seeming contradictions often force us to amend clearances and move the air refueling track to a locale with safer weather. Such changes may take valuable time and possibly detract from weather avoidance efforts.

The VOR tanker-directed rendezvous solves this problem. The technique requires very little planning, virtually no chart modification, and provides a point parallel (standard) rendezvous while freeing the airborne radar for thunderstorm avoidance.

In Fig 1, a suitable VOR has been selected as the air refueling control point (ARCP) and an appropriate inbound course, clear of thunderstorms, is chosen. The 250° radial inbound

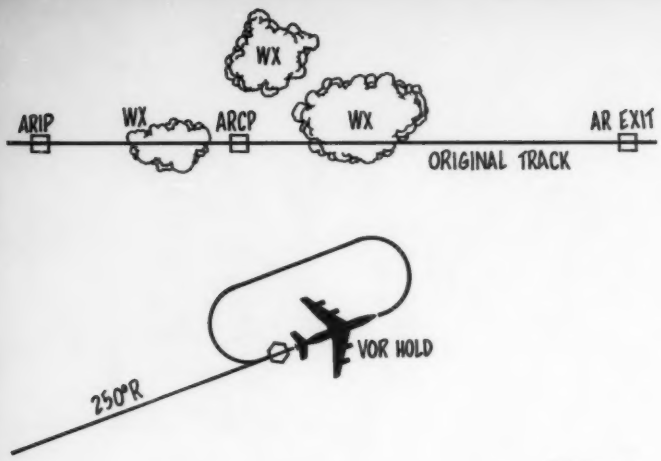


Figure 1

is selected and the pilot flies a standard VOR 1½ minute holding pattern on the 070° radial. Next, the receiver is contacted, informed of the change, and directed to obtain clearance to join the 250° radial, inbound, off the same VOR. Assume the receiver is about 100 to 120 nm from the station.

The tanker's clearance request should include a block altitude for rendezvous and air refueling with the standard 1,000′ vertical rendezvous separation and a minimum 10 nm corridor either side of the 250° radial out to 100 nm. After the receiver calls established inbound on the 250° radial, an appropriate pair of air-to-air TACAN channels is selected and exact aircraft separation confirmed. The tanker then proceeds outbound on the 250° radial (Fig 2).

Figure 2

To illustrate, let's assume an outbound drift correction of +5°. Conversely, the drift would be -5° for the inbound receiver. The tanker needs a 255° heading to track the radial while the receiver will require 065° to hold course inbound. If the tanker maintains a standard rendezvous airspeed of 275 KIAS, we can employ the table (Fig 3), from the Manual for Air Refueling, to calculate the turn range and offset for a point parallel rendezvous, based on drift and receiver true airspeed (TAS). We'll use a TAS of 340 kts which, when coupled with a drift of -5°, requires a turn range and offset of 21 nm and 10 nm respectively.

TURN RANGE

		DRIFT CORRECTION HEADING INTO ARCP							
		+15	+10	+5	0	-5	-10	-15	NOTES
C	1000	22	23	25	26	28	30	32	
	975	21	22	24	25	27	28	30	
L	950	20	22	23	24	25	27	29	
	925	19	21	22	23	24	26	28	3 NM
O	900	19	20	21	22	24	25	27	ROLLOUT
	875	18	19	20	21	23	24	26	
S	850	17	18	19	20	22	23	24	RANGE
	825	16	17	18	19	20	21	23	
U	800	15	16	17	18	19	21	22	
	775	15	16	16	17	18	20	21	
R	750	14	15	16	17	18	19	20	
	725	13	14	15	16	16	17	18	
E	700	12	13	14	15	16	16	17	
	675	10	10	11	12	12	13	14	
	650	9	10	11	11	12	13	14	½ NM
	625	9	9	10	10	11	12	13	
	600	8	9	9	10	11	12	12	ROLLOUT
	575	7	8	8	9	10	11	11	
R	550	7	7	8	8	9	10	10	RANGE
	525	6	7	7	8	8	9	9	
A	500	6	6	7	7	8	8	9	(A-10,
	475	5	6	6	7	7	8	8	A-37)
T	575	6	7	8	8	9	10	11	
	550	6	6	7	8	9	10	11	1 NM
E	525	5	6	6	7	8	9	10	ROLLOUT
	500	5	5	6	6	7	8	9	BEHIND
	475	4	4	5	5	6	7	8	C-130

OFFSET

		DRIFT CORRECTION HEADING INTO ARCP							
		+15	+10	+5	0	-5	-10	-15	NOTES
	460	7	8	9	11	12	14	16	
T	440	6	7	8	10	11	13	15	
A	420	6	7	8	9	10	12	14	30° BANK
N	400	5	6	7	8	9	11	12	
K	380	5	6	6	7	9	10	11	
E	360	4	5	6	7	8	9	10	
R	340	4	4	5	6	7	8	9	
	320	3	4	4	5	6	7	8	
T	300	3	4	4	5	5	6	7	
A	280	3	3	4	4	5	6	6	
S	260	2	3	3	4	4	5	5	
	240	2	2	3	3	3	4	4	

- **Use drift correction inbound to the ARCP and closure rate (receiver TAS added to tanker TAS) to determine turn range. Use drift correction inbound to the ARCP and tanker TAS to determine offset.**
- **When more than one tanker is involved, add 1 NM to the turn range for each additional tanker in the formation (except C-130 overtaking rendezvous).**

Figure 3

The receiver is then informed of the turn range and offset. Upon reaching 60 nm A/A TACAN separation, both aircraft turn right 10° (Fig 4). This turn is equal in degrees to the number of miles of offset and is based on the "1 in 60" rule of trigonometric angles. (The 1 in 60 rule states that each 1° of arc at 60 nm equals 1 nm of chord distance.) The tanker's new heading should be 265° and the receiver should fly 075°. The 075° heading becomes the rendezvous heading which the tanker either calculates or requests from the

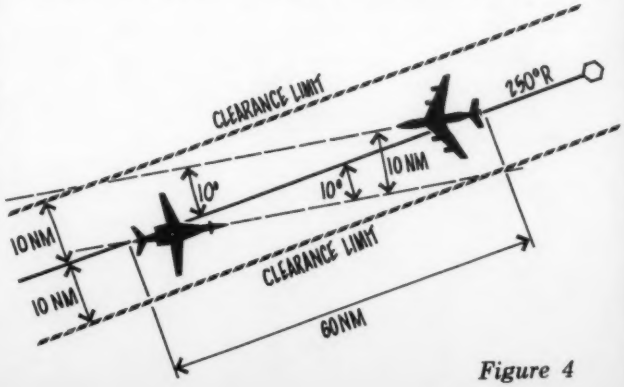


Figure 4

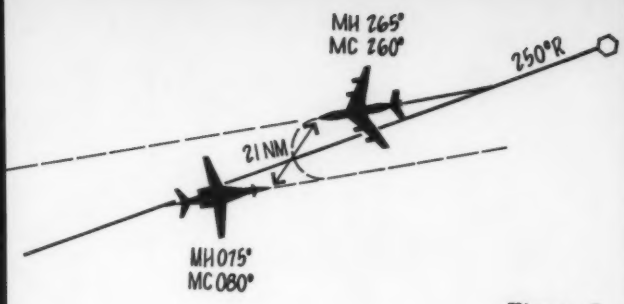


Figure 5

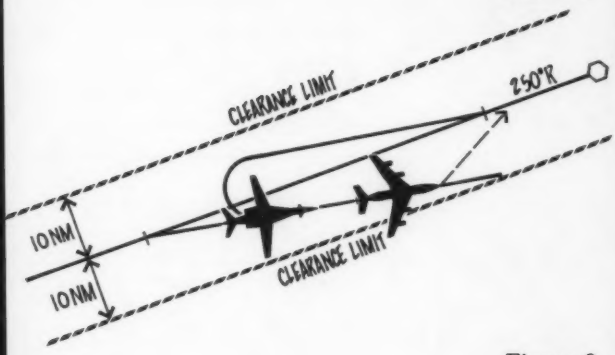


Figure 6

receiver. At 21 nm A/A TACAN, the tanker turns left to a heading of 075° (Figs 5 and 6).

With the rendezvous completed, a left turn of about 15° to 20° facilitates radial rejoin while keeping both aircraft within clearance limits (Fig 6). Following VOR station passage, the refuelers may wish to proceed outbound on another radial or alter course to some geographical point. Navigation after the VOR-ARCP is accomplished in the traditional manner.

A KC-135 has accomplished this rendezvous with both B-52 and RC-135 receivers with excellent results. The procedure offers many advantages. It relieves the navigator of extensive replanning and is accomplished on a moment's notice. The tanker directs the rendezvous while the receiver need only inform the tanker of his final heading. The technique is simple, but don't forget to rejoin the inbound course or request additional clearance from ATC, if needed. A VOR alternate rendezvous may save your day the next time bad weather complicates your refueling mission.

A 1974 graduate of the University of Colorado at Boulder, Capt Smith first was assigned to the Defense Mapping Agency, Warren AFB. After UNT and CCTS, he served as a KC-135 navigator. Capt Smith is now an instructor at Ellsworth AFB.

How to Save a Rendezvous

Captain Martin D. DUTILLY
93 AREFS
Castle AFB, CA

All of you receiver and tanker navigators have been there. Your disbelief in the radarscope is confirmed by a DF check. Your offset really is 25 miles to the left! The planned turn range/offset is 21/10, but you will never reach a 21-mile turn range with a 25 nm offset, will you? Those who back up the rendezvous with timing have recourse, but what alternative remains for the navigator who forgot to hack a stopwatch? When does he or she direct the tanker's turn?

Obviously, the theory behind a successful point parallel rendezvous requires one airplane to turn at an exact range from the rendezvousing aircraft. For example, if a B-52 is approaching a KC-135 at 440 TAS and 5° right drift, the classic 21/10 turn range/offset is easily derived from the air refueling checklist. The rendezvous will resemble the procedure depicted in Fig 1. Theory then predicts, quite accurately, that the tanker should roll out close to track about three miles ahead of the receiver.

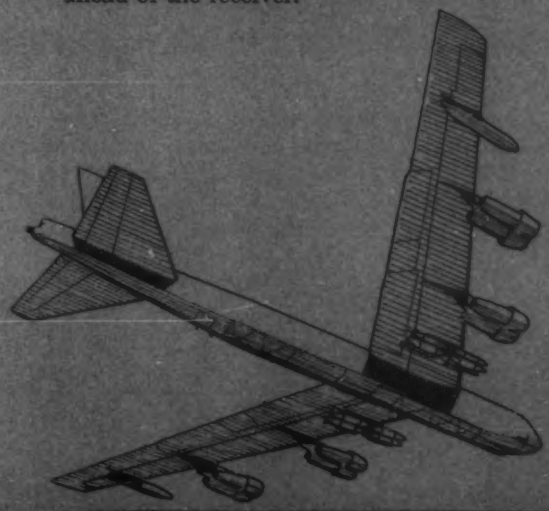


Figure 1

Borrowing from that great Grecian navigator, Pythagoras—he must have been a nav; he drew circles, lines, and triangles—we see from his famous theorem that:

$$(\text{TURN RANGE})^2 = (\text{OFFSET})^2 + (\text{FORWARD RANGE})^2 \text{ AND}$$
$$\text{FORWARD RANGE} = \sqrt{(\text{TURN RANGE})^2 - (\text{OFFSET})^2},$$

Forward range is defined as the actual distance, nose to nose, between aircraft. Turn range is the slant range between aircraft. Using Fig 1, we solve for forward range.

$$\text{FORWARD RANGE} = \sqrt{(21)^2 - (10)^2}$$
$$\text{FORWARD RANGE} = 18.4 \text{ NM}$$

Therefore, whenever your turn range/offset is 21/10, your actual forward range is 18.4 nm when the tanker turns, Fig 2. Remember, the turn is normally commanded by turn range (radar slant range or air-to-air TACAN DME), not forward range, but works as advertised only if the offset is correct or nearly so.

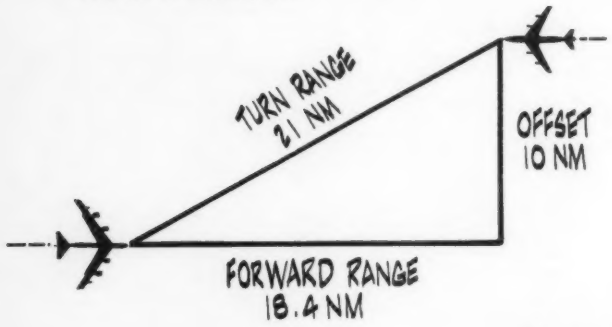


Figure 2

So what happens if the offset is only five instead of the desired ten miles? Figure 3 depicts a forward range of 20.4 nm when the tanker reaches the 21 nm turn range. Here the tanker has turned two miles early at 20.4 nm forward range. (Fig 2 showed 18.4 nm as the correct forward range.)

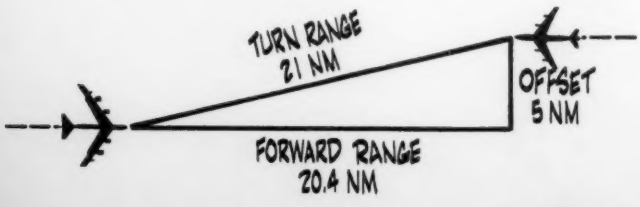


Figure 3

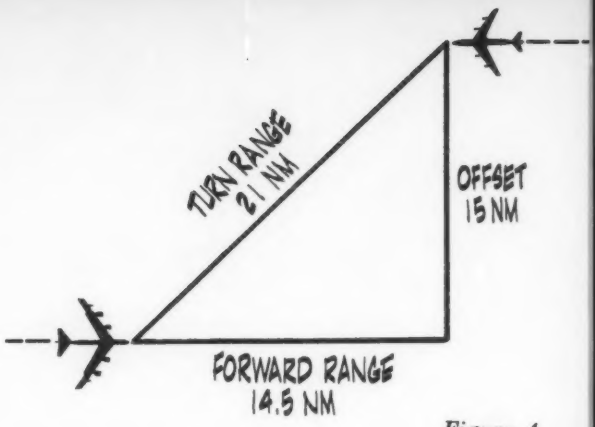


Figure 4

Result? The KC-135 ends up seven miles in front of his receiver rather than the three miles anticipated.

How about the wide offset? In Fig 4, the tanker turns approximately 4 nm late at 14.5 nm forward range instead of 18.4. Overrun! The BUFF will end up five miles ahead of the tank, unless corrective action follows.

Having determined, in Fig 2, that 18.4 nm forward range is where the tanker should turn, for a 21/10 planned turn range/offset, we again consult Pythagoras to determine:

$$\text{TURN RANGE} = \sqrt{(18.4)^2 + (\text{ACTUAL OFFSET})^2}$$

Therefore, if the turn will occur at 18.4 nm forward range, when should the tanker's turn be commanded with an incorrect offset? If your radar shows an offset of 5 nm, then:

$$\text{TURN RANGE} = \sqrt{(18.4)^2 + (5)^2}$$
$$\text{TURN RANGE} = 19.2 \text{ NM}$$

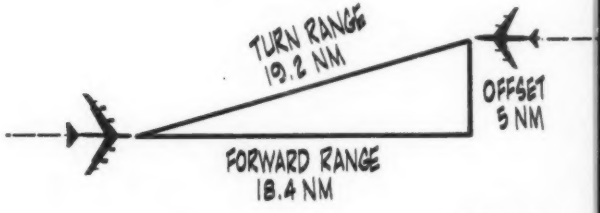


Figure 5

Granted, the tanker will not be directly in front of the receiver upon rollout (offset to the right), but more importantly, the KC-135 won't be seven miles ahead as depicted in Fig 3.

For the wide offset, 15 nm for example, here is what happens.

$$\text{TURN RANGE} = \sqrt{(18.4)^2 + (15)^2}$$
$$\text{TURN RANGE} = 23.8 \text{ NM}$$

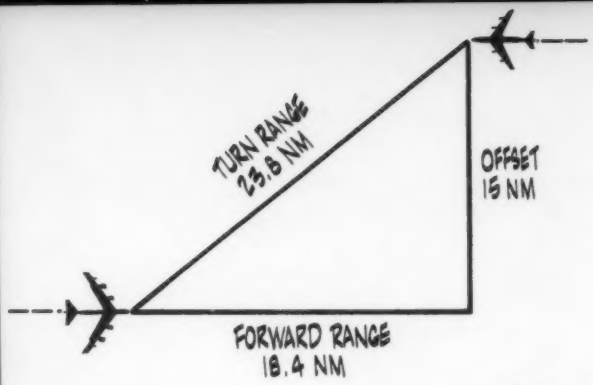


Figure 6

Again the tanker does not rollout directly in front of the receiver (offset slightly left), but the overrun, depicted in Fig 4, is avoided. All of these examples prove one point. No matter how the offset ends up, a rendezvous can be saved if the tanker turns at the correct computed distance (forward range) from the receiver.

Here's how to make the turn range procedure work. Enter the chart, Fig 9, along the row with your planned turn range/offset. Next, enter the column with your actual offset during the rendezvous—yes, you may have to interpolate. The extracted value is the range at which to command the tanker's turn. All chart values have been rounded to the nearest mile. Every possible turn range/offset combination, from the KC-135 air refueling manual, in the 400-480 KTAS range, is included.

Let's return to an earlier scenario to illustrate. Entering the chart with 21/10 and a 25 nm actual offset, we find that the tanker should be turned at 31 nm turn range (radar slant range or A/A TACAN DME), Fig 7. Although we never set out to create an undesired offset, if one should occur, this method can save a navigator without a stopwatch. It is also especially helpful for the nav who waits for a 21 nm call, only to see the offset never decrease below 25 nm.

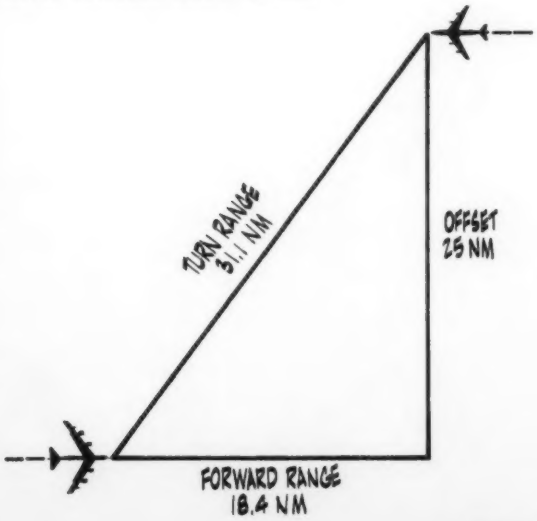


Figure 7

Incidentally, it doesn't matter if the actual offset is both incorrect and to the wrong side. Turn ranges are computed with a specific forward range requirement. If you expect 10 nm left offset and you actually have 15 nm to the right, the KC-135 still turns at 18.4 nm forward range for a planned 21/10 rendezvous. The chart instructs you to turn the tanker at 24 nm, Fig 8; however, you might consider turning the tanker to the right, versus the left, to close up the lateral spacing upon rollout. Either way the tanker turns, the corrected turn range produces three miles forward range between airplanes upon the tanker's rollout.

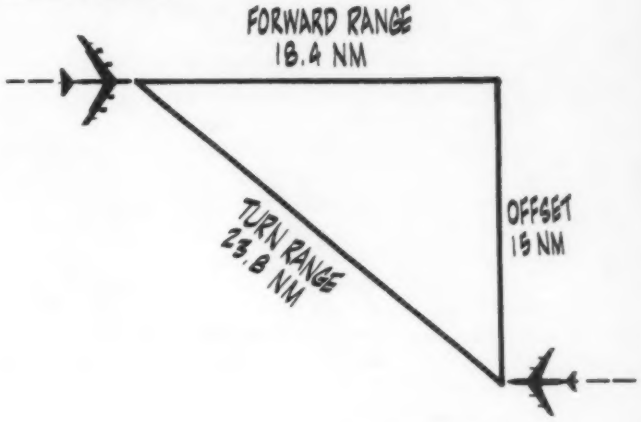


Figure 8

ACTUAL OFFSET (NM)

Planned TR/OFF	0	5	10	15	20	25
13/2	13	14	16	20	24	28
14/3	14	15	17	20	24	29
14/4	13	14	17	20	24	28
15/4	15	15	18	21	25	29
16/4	16	16	18	22	25	29
16/5	15	16	18	21	25	29
17/4	17	17	19	22	26	30
17/5	16	17	19	22	26	30
17/6	16	17	19	22	26	30
17/7	16	16	18	22	25	29
18/5	17	18	20	23	26	30
18/6	17	18	20	23	26	30
18/7	17	17	19	22	26	30
18/8	16	17	19	22	26	30
19/5	18	19	21	24	27	31
19/6	18	19	21	23	27	31
19/7	18	18	20	23	27	31
19/8	17	18	20	23	26	30
19/9	17	17	20	22	26	30

(continued on page 30)

Editor's Note: The Air Force awards any of seven different decorations for valor or heroism: the Medal of Honor, the Air Force Cross, the Silver Star, the Distinguished Flying Cross, the Airman's Medal, the Bronze Star Medal, and the Purple Heart. There is no parity among these seven awards—there is not meant to be. They are rank ordered by the degree of courage necessary to earn them. These seven decorations, along with all of the lesser awards for achievement and service, can be arranged in a pyramid of relative importance. The Medal of Honor—the supreme award—sits atop that "pyramid of honor."

Atop the Pyramid of Honor

Captain Donald W. RIGHTMYER
391 TFS/DO
Mt Home AFB, ID

Navigators, as well as their kinsmen in aerial combat—observers and bombardiers—are no strangers to the halls of danger. The Argonne, Ploesti, Schweinfurt, Pyongyang, Hanoi-Haiphong, and Desert One are only a few locations which demanded extreme dedication and sacrifice from American airmen. Since the beginning of aerial combat, six aviators serving in navigator-related crew positions have earned the Medal of Honor for their deeds of courage and sacrifice. Each award was presented posthumously. All but one of the recipients were second lieutenants.

First of our navigator brethren to earn the Medal of Honor was 2d Lt Erwin R. Bleckley, a DeHavilland DH-4 observer with the US Air Service in France during the First World War. His unit, the 50th Aero Squadron, flew DH-4s in close support of US ground troops during the Argonne Forest action. On 6 Oct 1918, Lt Bleckley and his pilot, 1st Lt Harold Goettler, were assigned to aid the "lost" 77th Division which had been cut off by German forces.

Earlier in the day, the two lieutenants had run the gauntlet of heavy enemy ground fire to drop supplies for the beleaguered Americans. On the second trip that same day, Lt Bleckley's plane was downed by German fire. Severely wounded, he died enroute to a hospital.

Air action over Europe, in the 1940s, again saw navigators and bombardiers pitted against German forces. The navigators and bombardiers, who earned the Medal of Honor, all served as B-17 crew members during that action.

An Eighth Air Force B-17 bombardier who earned the Medal of Honor was 1st Lt Jack Mathis of the 359th Bombardment Squadron. On 18 Mar 1943, he lead an entire squadron in a mission

2Lt Erwin

1Lt Jack Warren Mathis

2Lt Walter

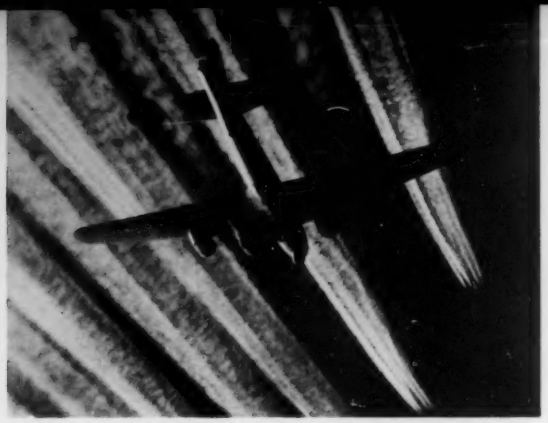
ssell Bleckley

2Lt Joseph Raymond Sarnoski

2Lt Robert Edward Femoyer

dward Truemper

2Lt David Richard Kingsley



against shipbuilding yards at Vegesack, Germany. The entire flight was to drop its bombs on Lt Mathis' "bombs away" call. He would make that split-second decision using a Norden bombsight coupled to the autopilot of his aircraft—*The Duchess*. From the time the bomb bay doors opened, *The Duchess* was in Lt Mathis' hands. He would steer the plane until the actual bomb drop.

As the squadron approached its target, they encountered heavy flak. Several bombers were hit and severely damaged. One antiaircraft shell exploded only 10 yards from *The Duchess* shattering the bombardier-navigator area of the airframe. Lt Mathis and the navigator were slammed against a bulkhead. Still, the bombardier crawled back to his undamaged bombsight. He rechecked instrument settings, released his own bombs and began his call over the radio, "Bombs ..." The navigator noticed Lt Mathis' delay in completing the call and thought he might be experiencing radio problems. The navigator ended the transmission by adding "... away!"

While *The Duchess* evaded more antiaircraft fire, the navigator noticed his fellow crewman had collapsed over the bombsight. Lt Mathis was dead from wounds in the arm and abdomen. His bombs, along with the rest of the squadron's, fell on target.

On 20 Feb 1944, 2d Lt Walter E. Truemper was navigating a B-17 over occupied Europe when his plane was attacked by a squadron of enemy fighters. The B-17's copilot was killed immediately, both the pilot and radio operator were wounded, and the plane suffered severe damage. Truemper and his remaining crew members regained control of the aircraft and arduously flew it back to their home base in England. After ordering the rest of the crew to bail out, Lt Truemper and the flight engineer attempted to land the damaged bird. Despite instructions from their squadron commander not to attempt a landing, Lt Truemper and the engineer continued. They took this action because the pilot was still alive and could not bail out. Unfortunately, the plane crashed on their third landing attempt. All aboard were killed.

A B-17 bombardier, 2d Lt David Kingsley, was decorated for his valor on a mission against the infamous refineries in Ploesti, Rumania. Despite heavy battle damage from enemy guns, Lt Kingsley's aircraft successfully struck and destroyed vital refinery facilities. After the raid, the bullet-riddled aircraft lagged behind the formation, only to be hit again by fire from 3 ME-109s. The gunfire wounded the tail gunner and inflicted still more aircraft damage. Lt Kingsley made his way back to the tail gunner and removed the gunner's harness and heavy flight clothing to treat his wounds. Eight more ME-109s attacked, causing even more extensive aircraft damage and crew injuries. When the pilot ordered bail out, Kingsley helped the others into their parachute harnesses. The tail gunner's harness could not be found so Kingsley removed his own and fitted it to the wounded gunner. As the crew bailed out, Lt Kingsley was last seen standing on the bomb-bay catwalk. The plane continued to fly on autopilot for a short distance before crashing in flames.

The final navigator to earn the Medal of Honor for action over Europe was 2d Lt Robert E. Femoyer. On 2 Nov 1944, the B-17 he navigated over Merseburg, Germany, was struck by antiaircraft fire. Though severely wounded in the side and back, Femoyer refused a morphine injection. Despite extreme pain and loss of blood, he was determined to stay alert to direct his plane safely home. Since he couldn't lift himself off the floor, Lt Femoyer had to be propped up to see his charts and read the instruments. After 2 ½ long hours, the lone B-17 crossed the English Channel and the young navigator felt he had fulfilled his obligation. Only then did he take a sedative. He died shortly after being taken from the plane.

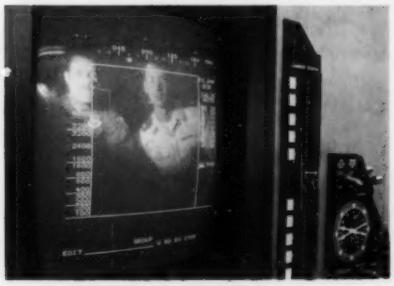
In the Pacific theater, the only bombardier to earn the Medal of Honor was 2d Lt Joseph R. Sarnoski. He volunteered for an important mapping mission over the Buka area of the Solomon Islands. As the mission neared completion, over 20 enemy fighters attacked.

Sarnoski manned the nose gun and fought them off. A second frontal attack severely damaged the B-17 and wounded five crew members including Sarnoski. Despite his wounds, the lieutenant continued firing and was able to down two enemy fighters. After a 20-millimeter blast knocked him back under the cockpit, Sarnoski returned to the nose gun and continued firing until collapsing from mortal wounds. Without his action to defend the bomber, the mission would have failed.

If the names of some of these navigators, observers, and bombardiers sound strangely familiar, it just might be because some of the navigator training buildings at Mather AFB have been dedicated to their honor—Bleckley Hall and Femoyer Hall are two. The bravery of these six aviators was recognized by the award of our country's highest decoration for courage in combat. Countless other navigators, bombardiers, and observers have made inestimable contributions to the heritage of the U.S. Air Force and the Air Force navigator's tradition. Bleckley, Sarnoski, Mathis, Truemper, Femoyer and Kingsley have paved the way for modern navigators. Their names exemplify courage and supreme sacrifice in the employment of air power for the defense of freedom.

Capt Rightmyer graduated from the USAF Academy in 1973 with a degree in History. After UNT and F-4 RTU at Homestead, he flew F-4s in Korea, England, and West Germany. Next came assignment to the HQ USAF Office of History. Capt Rightmyer now serves at Mt Home AFB.

The rebirth of TEWS *in* ATC



Captain Natividad ARRIETA, Jr.
453 FTS
Mather AFB, CA

Captain William F. SMITH
323 FTW/DOTCE
Mather AFB, CA

The recent addition of the EF-111A Tactical Jamming System (TJS) to the USAF inventory has revived a valuable concept long absent from Electronic Warfare Officer Training (EWOT)—tactical electronic warfare support (TEWS). This article will relate the history and rebirth of TEWS training conducted by the 453d Flying Training Squadron, Mather AFB, California. We'll start by tracing the evolution of the TEWS concept in Southeast Asia (SEA). Next, we'll discuss TEWS training during the Vietnam era and, finally, we'll describe the impact of our new TEWS aircraft on the EWOT curriculum, including the classroom and our AN/ALQ-T5 Electronic Warfare Training Simulator.

Basically, tactical electronic warfare support evolved along with EB-66C SEA operations. When it was the only USAF aircraft in SEA with an electronic countermeasures (ECM) capability, the EB-66C penetrated with strike and reconnaissance forces in an "escort" role directed against terminal defense radars (surface-to-air missile systems, antiaircraft artillery, and airborne inteceptors). Later, when fighters gained ECM pods to jam these radars, the EB-66C withdrew to less hostile airspace where it was used in a "barrier" role (against early warning [EW], height finder [HF], and ground-controlled intercept [GCI] radars) to mask the approach of the strike force and in a stand-off role to deny information to acquisition radars. The denial of information to EW, HF and GCI radars considerably complicated the enemy air defense problem and thereby dramatically contributed to our overall air effort.

Recognizing the significance of this support concept, the 453d (then the 3537th Electronic Warfare Training Squadron) incorporated TEWS

into the EWOT curriculum by creating the Strike Support Systems phase of instruction. A representative EB-66C ECM suite (comprised of ALT-27, -28, -31, -32, -34 jammers, APR-17 and ALR-27 receivers, and an APR-36/37 radar warning receiver) was added to the T5 simulator. A revised academic syllabus covered the new equipment, tactics, and procedures. Following academics, TEWS training used changing scenarios to simulate the barrier, stand-off and escort roles.

EB-66C - the original TEWS aircraft.

Although the concept of jamming the entire threat signal environment in these three roles remained valid, reality soon brought the Strike Support Systems phase to an end. Increased threat sophistication forced EB-66C orbits away from threat areas and greatly diminished EB-66C effectiveness. The extensive modifications required to update EB-66C performance capabilities and ECM would have yielded insufficient maneuverability and survivability. Consequently, the EB-66C force was retired. Shortly afterwards, the 453d's Strike Support program ended.

The demise of the EB-66C left the 453d with a partially obsolete primary simulator and created a void in a major area of electronic warfare operations. But like the phoenix, which burned to ash only to arise young, vigorous, and more beautiful, USAF TEWS has been reborn in the EF-111A TJS.

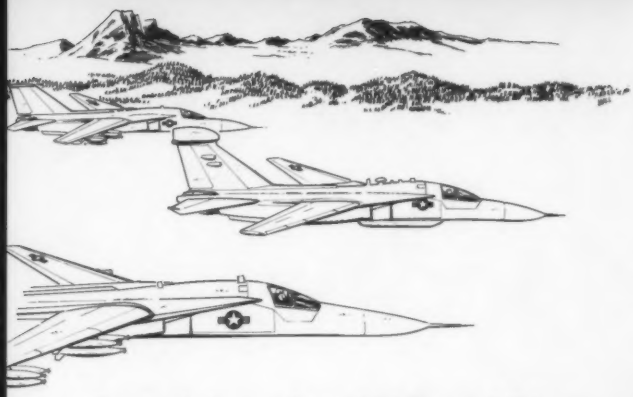
EF-111A Tactical Jamming System.

The TJS represents a quantum leap in TEWS mission capabilities. Before, the effectiveness of the EB-66C was limited by jamming capability and the EWO's manual dexterity. Through computers and automation, the new TJS can dedicate the equivalent of 40 transmitters against hundreds of radars while retaining EWO manual management. With this expanded capability and a tactical fighter's performance and maneuverability, the survivable TJS opens doors long closed to the TEWS mission.

Rather than recreate the Strike Support Systems training phase, the 453d logically gave the task of teaching the TJS to its Tactical Systems flight whose primary mission is tactical electronic warfare. Until recently, tactical systems emphasized Wild Weasel operations and fighter ECM equipment. Addition of the TJS has significantly broadened training responsibilities.

The TJS impact on 453d operations has followed two parallel courses. The first involved modifying the T5 simulator to incorporate TJS features. The second centered on developing classroom academics. Experience shows that hands-on training is the most efficient teaching method for equipment operation. With simulators, the hands-on method is also the most economical means of meeting flying training objectives. Considering these advantages and the fact that, once modified, the T5 will be an interim EF-111A crew continuation training device, the Air Force funded a 9½ million dollar modification to replace the EB-66C suite with the TJS. Changes include adding all ALQ-99E Jamming Subsystem control and display panels, the ALR-62 Countermeasures Receiver Set portion of the Terminal Threat Warning System, the ALQ-137, and a modified ALE-28 Countermeasures Dispensing Set portion of the Self-Protection Subsystem. Also, a second student data terminal will be installed for student/T5 computer interface. The projected modification completion date is Oct 1984.

Student trains on AN/ALQ T5 simulator.



Academic instruction, which began 2 February 1983 with Class 83-05, presented a real challenge to the 453d since we had no EF-111A experience. To resolve this dilemma, four ATC instructors attended the Grumman EF-111A Aircrew Course. Their expertise spans all areas of EWOT impacted by the TJS—operations, electronics, computers, curriculum, and instructional systems development.

Another planning challenge involved development of course training materials. Everywhere we turned, we were breaking new ground with the TJS. There were no precedents for objectives, time allocation, instructional materials, etc.—everything was new. This problem also hindered our search for source references and graphics support. However, we persevered, wrote the course and training materials, and incorporated the TJS into the EWOT syllabus. The result is 34 hours of academic instruction and 19 hours of simulator training. The new academic phase provides an in-depth study of the functions and capabilities of the ALQ-99E Jamming Subsystem followed by a detailed look at its operation. Once students thoroughly understand the ALQ-99E, the other TJS subsystems are introduced. With each system completely covered, T5 simulator training reinforces academic knowledge.

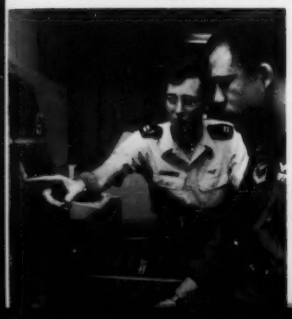
Since the T5 will not be available until late 1984, our biggest challenge was finding an interim training device. The goals for a mock-up changed as new possibilities arose. Initially, the plan was for desk-top devices consisting of equipment panel decals on wood. Then, a part-task trainer was conceived which had operable but non-functional controls. Instrument displays were simulated by the instructor controlling a built-in slide projector. Slide displays coordinated with student control responses. However, the availability of Apple II Plus computers added a new dimension to the part-task trainer design. Through our use of a locally developed program and a TV monitor, portions of the temporary trainer are now functional. With this mini-simulator, students can accomplish checklists and practice operating procedures.

EF-111A desk top trainer.

Initial feedback from validation and student critiques indicates that the course is successful beyond our original expectations. In the end, the 453d, through initiative and imagination, has finally filled the long-standing void, left by the departure of Strike Support Systems, with an effective and viable training program. Thanks to the EF-111A TJS, tactical electronic warfare support is reborn, healthy, and growing stronger every day in the Air Training Command.

Capt Arrieta graduated from the University of Texas, El Paso, in 1972. After UNT and EWOT, he was assigned to the F-111A in Thailand. In 1975, he served at Nellis AFB before duty at Lakenheath, UK. Presently assigned to Mather AFB, Capt Arrieta is Tactical Systems Assistant Flight Commander.

In 1973, Capt Smith graduated from the University of Maryland. After UNT, EWOT and CCTS, he was assigned to K. I. Sawyer AFB in 1976. He obtained an MA in History from Northern Michigan University in 1979. Capt Smith is Electronic Warfare Training Curriculum Manager.



Capt Roc White explains ALQ-99E displays.

Considerations for the Rated Supplement, SDAs, and PME

OPS CHECK: *Your Career*

Captain Curt OSTERHELD
1 SRS
Beale AFB, CA

The Rated Supplement...Exchange Tours...AFIT...ASTRA...PME...all those mysterious terms we've heard for years, but for many of us, they remain unexplained. Maybe it's time to examine opportunities for navigators away from operations—those magical "good deal" programs that often seem shrouded in secrecy.

I offer a brief overview of two job opportunities that fall under the title of "career broadening." You SOS grads can stop looking for three main points because my objective is to stress these two opportunities that can enhance your career development, personal satisfaction and, most importantly, your value to the USAF. I'll also touch on your individual career development plan and, a valuable career tool, the AF Form 90.

Everyone knows about career development, yet there is no single approved solution. Let's try to establish some general criteria that can help you set a career course. First, establish your immediate and long-term objectives. You wouldn't consider flying a combat sortie without a sound understanding of what you were supposed to accomplish. You shouldn't progress through your professional life without some substantive goals. Set up a game plan for yourself. Where would you like to go and how will you get there? Next, put your plan to work, but remember to make it realistic. Your first job out of CCTS probably won't be at the Pentagon, so keep things in perspective and stay flexible! Good game plans always include back-up plays. Remember, a career can follow many different routes to meet an objective.

This article cannot cover the rated officer assignment cycle in detail. That's already been done for you in AFP 36-6, the Assignment Information Directory, or AID. I highly recommend that you take time to study this well-written pamphlet. It will provide insight into how an Air Force officer's assignment is determined and will forever dispel the notion that all assignments are generated by THE ALMIGHTY COMPUTER. Also, the AID contains valuable information on all of the service schools and provides a detailed rundown on each block of the AF Form 90. As a single source document that translates "personnelese" into aviator language, you can't beat the AID.

Let's first consider your entry into the rated supplement. The supplement often has been misidentified as a "place to put extra pilots and navigators until they're again needed for flying." It's more than that. It is, in fact, part of the total Air Force requirement for rated officers in the rank of lieutenant colonel and below. These officers serve in any of 44 support career areas, complete AFIT programs, or attend intermediate or senior service schools.

The rated supplement objective is twofold. First, it provides necessary rated expertise in many

technical areas, usually staffed by nonrated personnel. These functions benefit from the presence of a rated officer. Second, by moving rated officers into nonrated career fields, they gain broader experience that increases their value to the Air Force. Why is career broadening so important? Well, about 75 percent of the officers promoted to colonel wear wings. Over 75 percent of the jobs colonels hold, however, are in non-flying specialties. It's in the best interest of the Air Force to give its future colonels some breadth of experience as preparation for the responsibilities of command.

How do you enter the rated supplement? Via one of four primary avenues:

1. The Rated Officer Review Board (RORB) identifies individuals for supplement duty. Chapter 2 of the AID explains the RORB function in detail. I'll characterize it as an assignment review board comprised of senior rated and nonrated personnel specialists. The RORB recommends you for assignment to rated or nonrated areas. Your gate time, personal preferences, outyear management requirements, and a number of other factors are considered— all in the broad view of Air Force needs. Indicate your preference for supplement duty in section IIC on your Form 90. If you're a mid-level captain, with a solid operational background, it's time to put your supplement preference in writing. Make your desires known to the RORB.

2. The second rated supplement avenue of entry is the Air Force Institute of Technology (AFIT). Assignment to a supplement career field related to graduate degree work usually follows this schooling. AFIT conducts educational programs in scientific, technological, managerial, medical and other selected fields. Most technical and managerial degree programs are taught at Wright-Patterson AFB, Ohio. A limited number of other programs are offered at civilian schools around the country. Besides these master's and doctoral degree programs, AFIT sponsors continuing education programs, for Air Force people with technical and managerial skills, to meet immediate, specific Air Force needs. AFIT also manages the Education with Industry (EWI) program described by Capt Bill Ehler in the Summer 1982 issue of THE NAVIGATOR. If you're interested in AFIT opportunities, talk with someone at your Base Education Office or contact the AFIT academic counselors at Wright-Patterson AFB (AV 785-6231).

3. Individual requests to join the supplement are also considered. Personnel resource managers encourage your inputs or requests through AFMPC. Each request is reviewed considering specific support career-field needs, rated-force requirements, and an applicant's unique qualifications, with emphasis on educational credentials.

4. Finally, approval of a special duty application (SDA) for a specific support area can be your ticket to the supplement.

Check AFR 36-20, Chap 8, regarding the SDAs available. You'll find a complete list with a brief description of each duty, as well as application procedures. Again, your best communicative tool is the SDA block on your AF Form 90. Want to be part of the ASTRA program that Capt Tom Waddell described in THE NAVIGATOR's Winter 1982 issue? Would you like to teach at the Air Force Academy or fly the SR-71? Get AFR 36-20, Chap 8, and go for it. Special duty jobs rarely come looking for you. You must aggressively plan and pursue them as you would any other step in your career.

An essential part of your career development is Professional Military Education, or PME. Starting with Squadron Officer School, PME is structured to improve your leadership, management, and communicative skills as well as to show you the many facets of this vast profession we call the USAF.

Later in your career, there is Intermediate Service School and Senior Service School. Go back to our old friend, the AID, and review Chap 5, section D, for more information on school locations and course lengths. I want to stress that you cannot apply for residency at intermediate and senior service schools. Rather, selection is a competitive process, with selectees identified by promotion boards. What this means to you is, first, keep your hard-copy records up to date. Make sure your PME desires are reflected on your AF Form 90. Then, don't wait for a residence quota opportunity. Go to your base education office and enroll in a correspondence/seminar course.

I've mentioned the "AF Form 90" often in this article, with good reason. The Form 90 is a superb communication tool. Again, AFP 36-6, Chap 6, outlines every section of the form in detail. Speaking from a former resource manager's perspective, one of the Form 90's most important blocks is the "Remarks" section on the back. Here's a chance to use your effective writing techniques to tell the world, in plain English, exactly what you want. Give a detailed plan of your entire career, or simply rank order your objectives.

(continued on page 30)

Navwords

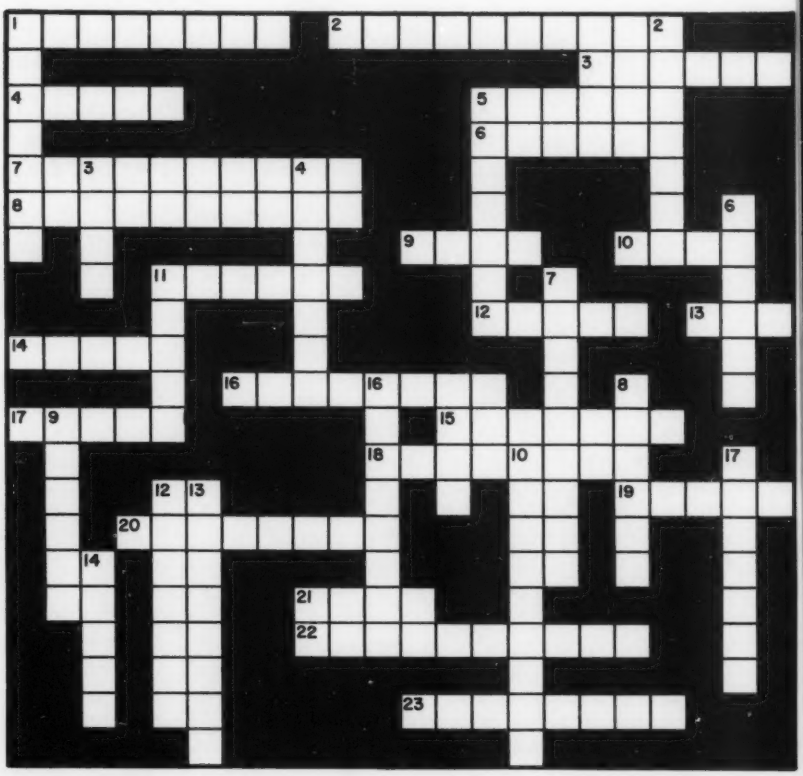
Timothy C. MICHALAK

ACROSS

1. Line connecting points of equal atmospheric density
2. Insulating material between the plates of a capacitor
3. Any non-directional device radiating energy equally in all directions
4. A form of molecular oxygen
5. The ratio of the square of the span to the total area of an airfoil
6. Point of an observer on the earth's surface vertically overhead
7. Instrument portraying star altitude curves on a chart
8. Instrument for measuring cloud heights
9. Small detached cloud masses moving before the wind
10. Angle between true vertical and the axis of a gyro
11. Tropical cyclone in the Philippine Islands
12. High Precision SHORAN
13. Angular displacement about the Z, or vertical axis
14. Point of an observer on the earth's surface vertically beneath
15. Graphite coat on the inside of some CRTs for collecting secondary electrons emitted by the screen
16. That part of a shadow in which light is partly cut off by an intervening object
17. Transformer used to couple a balanced to an unbalanced transmission line
18. Another name for a Rhumb course
19. Luminous line produced on the CRT screen by electron beam deflection
20. That part of a logarithm to the right of the decimal point
21. Collective term for all the magnetic lines of force in a region
22. The dissipation of energy by travel through a medium
23. Time rate of motion in a given direction

DOWN

1. Line connecting points of equal speed
2. Electron emitting electrode of a vacuum tube
3. Angle of inclination from the horizontal or vertical
4. A 360° angle
5. Horizontal direction of a celestial point from a terrestial point, expressed as the angular distance from a reference direction
6. Order to destroy hostile airborne objects by air defense weapons
7. Iridescence
8. Oil used as the liquid in some magnetic compasses
9. Practical unit of current
10. Horizontal movement of part of the atmosphere
11. Violent northeast storm of southern Russia and central Siberia, similar to a blizzard
12. Type of communications jamming which sounds like three or more audio notes continually repeated
13. Glass or metal housing of a vacuum tube
14. Error caused by misaligning the instrument sighting mechanism
15. Distance from the center of gravity of an object to some point on that object
16. Term referring to a cloud the lower surface of which is pouch or breast formed
17. Angular relationship of one object to another



Editor's Note: You'll notice that our crossword puzzle is slightly unorthodox. Not all letter combinations form words. Some entries begin in the middle of other words or letter groups. Still the mix of current and old navigation terms, along with others from science and geography, should provide a challenge. The solution is on pg. 29.

OAS-
SOMETHING NEW FOR THE B-52

First Lieutenant Gregg A. MONACO
23 BMS
Minot AFB, ND

A new navigation system—the Offensive Avionics System (OAS)—is rapidly appearing in the SAC B-52 (G and H model) Stratofortress fleet. This article provides preliminary insight into that system.

When President Carter cancelled the original B-1 bomber program, the Air Force accelerated development and production of an air launched cruise missile (ALCM) to be carried by the B-52 and delivered from a standoff orbit. Attaching more ordnance on the aircraft posed no problem, but accurate delivery did. The ALCM's high subsonic speed, over vast distances, required more accurate information at launch than that provided by the B-52's ASQ-38 bomb-nav computer. Thus, development of digital-format B-52 avionics ensued.

The OAS, developed by Boeing, affords bomber crews the simplicity, flexibility, and accuracy of advanced systems while accommodating a large selection and quantity of weapons. Installing the OAS requires removal of the old ASQ-38 bomb-nav system, radar, astrotracker, and heading systems. Modifications extend from "downstairs" through interfaces in the pilot's compartment.

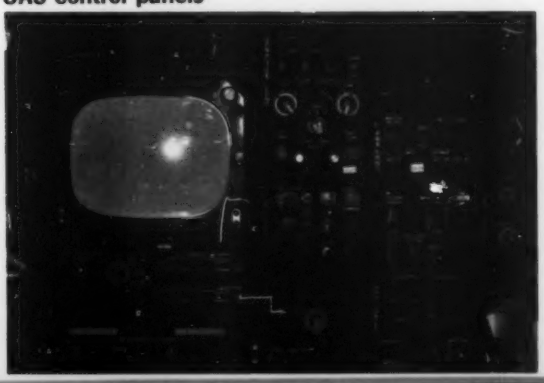
At its heart, the OAS incorporates two INS units and three processors. Unlike a traditional INS, OAS inertial components don't rely upon accelerometers and torquing to sense movement. Rather, the OAS is designed around a complex mathematical model which employs spatially spinning beryllium balls to measure acceleration. Although very complex in theory, the OAS inertial function is quite straightforward. During ground checks, the navigator loads in data transfer unit cartridges (DTUC) and applies OAS power. The machine does the rest.

The DTUC, a cassette computer tape, contains basic operational information derived from navigation fact and theory. This information tells the computer how to navigate. The computer needs approximately 2½ minutes to assimilate the same information given Mather's student navigators in 10 months of training. A basic operational computer tape and another DTUC, with specific mission-profile data, is loaded into the OAS. The mission profile tape contains a specific day's flight plan and sequence of events. A third DTUC records flight data, eliminating the need for a navigation log.

On the ground, the OAS starts inertial navigation when either ground or air align is commanded. Otherwise, the navigation process starts with an airborne instruction to air align. For quick response takeoffs, however, the alter nav system comes into play. The OAS alter mode uses Doppler information and AHRS (attitude heading reference system) inputs to determine aircraft position. This system compares roughly to the NCS found on Mather's T-43 aircraft, although it is more sophisticated due to our strategic mission.

In any navigation mode, the autopilot can be coupled to the OAS to precisely fly centerline or alter to any selected point. The OAS steering feature can be used at high or low altitudes.

OAS control panels



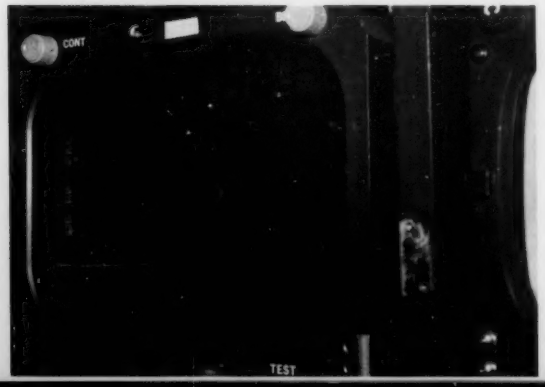
OAS integrated keyboard and tracking ball

Besides reducing crew fatigue, OAS steering enhances coordination by affording crew members increased time to plan ahead of the airplane.

The navigator and radar navigator interact with the OAS through an integrated keyboard (IKB). The IKB also enables manual inputs to the OAS for modifying stored data which includes flight plan and target information, offsets, and fixpoints available along any leg of flight. By typing appropriate commands on the IKB, the OAS solves any timing or navigation problem. It does the work of your MB-4, plotters, and dividers, but with silicon-chip speed. However, as with any computer, the operator must use care when inserting information.

Four multifunctional displays (MFD) reflect OAS/aircraft information. The IKB inputs data to the MFDs (two each for the navigator and radar navigator). Based upon operator selection, an MFD can display black-and-white TV or forward-looking infrared imaging from the electrooptical viewing system, radar, or any type of flight plan, target, destination/action information. Each MFD operates independently. The navigator and radar navigator work synergistically, sharing information and backing up one another. Initial MFD program displays include such prime mission data as current zulu time, present latitude and longtitude, altitude, TAS, track, winds, DCA, groundspeed, TH, MH, ETA to next waypoint, minutes ahead or behind flight plan, distance to next waypoint and number of programmed fixpoints for the current leg. The display also permits the navigator to check data on flight plan legs still ahead.

Radar presentation



Radar presentations also can be displayed on an MFD. Images are generated by the modified advanced capability radar. The radar presentation range varies from 3 to 200 nm in either a linear or logarithmic mode. The picture is tuned against an ideal standard of 16 shades stored in the computer's memory. Besides fixed range marks and heading marker, an optional dashed track line can be displayed. The traditional tracking handle or "joy stick" for positioning the radar cursor on a target has been improved with the OAS. A tracking ball, like those on video games, is located on the IKB. Movement of the ball positions the electronic radar cursor (plus sign). An automated OAS feature prepositions the cursor on or near the offsets, fixpoints, or targets. This automatic cursor positioning is then refined with the tracking ball.

The OAS fixes by four methods: terrain correlation, radar, electrooptical and overfly. The most accurate fix is the terrain correlation (TC or TERCOM), the least is the overfly. That's right, a radar autofix is only second best. What is TC? Basically, TC compares radar altimeter measured terrain profiles, along a predetermined path, with stored data developed by the Defense Mapping Agency. The OAS combines the radar altimeter readings to construct a mathematical landscape. It then compares this landscape with stored data and signals the operator if the information is reliable. The term TERCOM derives from this terrain comparison process.

Radar navigator management panel

As for weapons delivery, the OAS automatically computes ballistics to precisely drop gravity weapons. That capability, alone, eliminates a considerable amount of paperwork

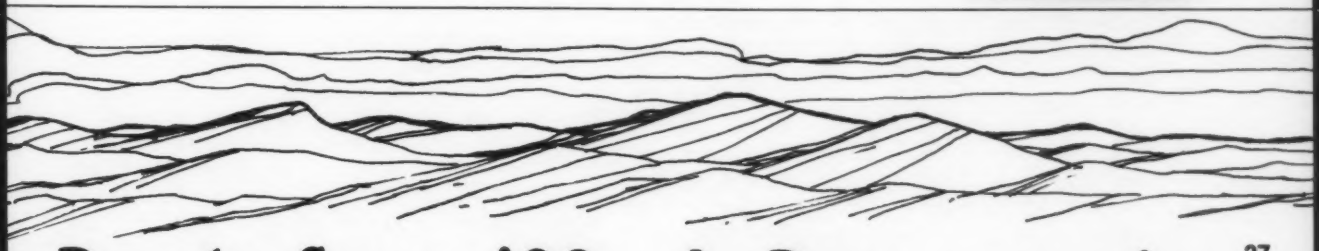
formerly accomplished by the radar navigator and navigator. The OAS also compensates for wind effect and fluctuations in airspeed, up to the bomb-release-committed point. Both the short range attack missile, carried in the bomb bay, and air launched cruise missile, carried on wing pylons, can be launched to strike targets not directly beneath the bomber's flight path.

Besides these broad capabilities, the OAS also supports aerial refueling rendezvous. With the proper commands, crosshairs can track a tanker beacon. The OAS computes rendezvous turn range and offset while providing distance and time to go for the intercept. It positions the bomber for an ideal rollout.

Until recently, we've envisioned *Star Wars* technology as "just around the corner." The OAS is real and here today. It brings space age advances to that faithful workhorse we call the BUFF.

The B-1B will have a modified OAS at its heart. With new ECM equipment and high performance from the B-1B's variable geometry wings, F101-GE-102 engines, and OAS-experienced navigators, SAC can contain the threat for generations to come.

A graduate of Indiana University, Lt Monaco was commissioned through OTS in 1980. After UNT and NBT, he completed CCTS at Castle AFB. Lt Monaco now serves at Minot AFB.



Bomb Comp '82 - A Retrospective

Captain Louis E. CHRISTENSEN
23 BMS/CCE
Minot AFB, ND

Date: 7 Nov1982. We were airborne just over five hours. The mission was progressing smoothly and we had just completed our high altitude release over the Bismarck range with good results. The crew efficiently completed checklists in preparation for our first low-level bomb run. We hit the IP two seconds early, banked right and rolled out on centerline after a 50° turn. Praise be to the OAS! After adjusting airspeed to make good our 0816Z release time, we riveted our collective awareness on the bomb run. The copilot had just reported the IP when the gunner quietly asked, "Does anybody else smell smoke?"

For a split second, silence prevailed as the crew processed this new input. Smell smoke ? Sniff... No, nothing. The offensive team returned its attention to the bomb run. But, at the defensive station, things were taking a definite turn for the worse. As the gunner watched in horror, the faint odor turned to visible smoke. It began to pour from behind the ECM panels. In the cracks between the panels, flames flickered as the fire engulfed the wiring. Frantically swiveling in his ejection seat, the gunner notified the AC and grabbed a fire extinguisher. As the smoke thickened significantly, the EW shut down his ECM equipment. Following that action, the defensive team was extremely relieved to see the fire die.

Amidst the growing excitement, the rest of the crew quietly kept the bomber on centerline and on time as the radar navigator found his final bombing offsets. Twenty seconds to go, tone on, bomb doors open, bombs away! On target, on time, copy post release information, turn at the end-maneuver point, and check timing again. What is the status on the fire?

Such is the dedication of a SAC Bombing and Navigation Competition mission. When trophies can be won or lost by split-second decisions, the total concentration of every crew member is a must. In SAC, as in the rest of the Air Force, we prioritize our missions. Our EWO mission is at the top of the heap. Then come Operational Readiness Inspections, evaluation check rides, and routine training. Every mission requires a high level of individual dedication—then, there is Bomb Comp! Since 1948, this command-sponsored event has offered an arena for far-flung units to enter their best crews and aircraft in competition for bragging rights to the title of SAC's best! An excerpt from *The Development of the Strategic Air Command*, 1946-1981, describes the birth of SAC's bombing competition:

> Confronted with serious manning, supply, and administrative problems throughout its first two years of existence, the Strategic Air Command was unable to devote much time to bombing practice. Bombing accuracy fell far below desired standards. Hoping to stimulate interest in improving bombing accuracy, General Kenney decided to hold a bombing tournament, which came to be called the SAC Bombing Competition. The first competition was held at Castle Air Force Base, California, from 20 to 27 June 1948. Ten B-29 groups participated, with each group represented by three crews. Each crew accomplished three visual bomb releases and three radar releases from 25,000′ altitude. The Eighth Air Force's five entries swept the first five places in the competition, with the 43d Bomb Group being the top unit. Trophies were presented to the 43d and to the winning crew, a 509th Bomb Group entry commanded by 1Lt M. L. Jones.

Although the Bomb-Comp crew selection process varies, local preparation begins approximately eight months prior to the actual tournament with an in-unit competition lasting two to six months. Two bomber and two tanker crews are selected based on bombing and electronic countermeasures effectiveness for the bombers and celestial navigation, overall navigation, and time control for tankers. After selection, aircrews are assigned to locally designated Bomb Comp aircraft. For the next two months, competitors focus their energies on studying rules, planning missions, honing crew coordination, and fine-tuning equipment.

The actual competitive missions consist of one night and one day flight for each crew. Bomber sorties (B-52 and FB-111) include one high-altitude release, four low-altitude releases, several SRAM launches, a low-altitude fighter exercise, and electronic countermeasures work at four sites. In addition, time control and terrain avoidance are scored for each flight. Each tanker mission encompasses a radar run, a celestial navigation leg, an orbit exercise and an INS run, all of which are scored for time control and circular error.

In fairness to all participating units, no scores are released until the first night of the SAC Bombing and Navigation Symposium. Thus, attendance at this meeting can be one of the most suspenseful and exciting experiences in a SAC crew member's career.

On 22 Nov 1982, we stepped off a C-135 at Barksdale to represent the 5 BMW at the symposium. Spirits soared in spite of mounting tension and anxiety over our scores. The Strategic Air Command had planned a welcome that was nothing short of breathtaking. The literal "red carpet" was rolled out in front of base operations. We descended the passenger stairs to the rousing notes of the Air Force Song, played by the Eighth Air Force Band. Bedecked in glittering chrome and spotless uniforms, the security police honor guard rendered a sharp salute. At the foot of the steps stood Major General John A. Brashear, SAC Chief of Staff for Operations, enthusiastically shaking hands and welcoming the competitors.

The convention was a whirlwind of activity. After checking into quarters, we returned to the base and eagerly awaited the scoring ceremony. Since award presentations would not occur for several hours, we enjoyed ourselves by visiting displays set up by participating units and air divisions. There we sampled foods representing the many diverse locales from which competitors hailed. The booth set up by the Royal Australian Air Force (RAAF), which had sent four F-111 crews to the competition, was a crowd favorite, specializing in indigenous cuisine from "down under."

Finally, the scoring ceremony began. It was a very dramatic, well-choreographed proceeding that played upon the tension of every crew member—tension which was relieved with many whoops and hollers as scores were announced. Each category's top three competitors were named with the actual winner left in doubt until the last possible moment. After results were posted, the trophy winners gathered for photographs.

During the symposium's final two days, many crews attended optional competition analysis

seminars or visited industry displays representing nearly every company in the military-aviation industry. The convention closed with a formal trophy presentation on the third day.

Bomb-Comp is the mating of man and machine to achieve precision. I emphasize the human factor, for without aircrew judgment, experience, talent, and determination, our multimillion dollar aircraft would be useless. The impact of machines, however, is steadily growing.

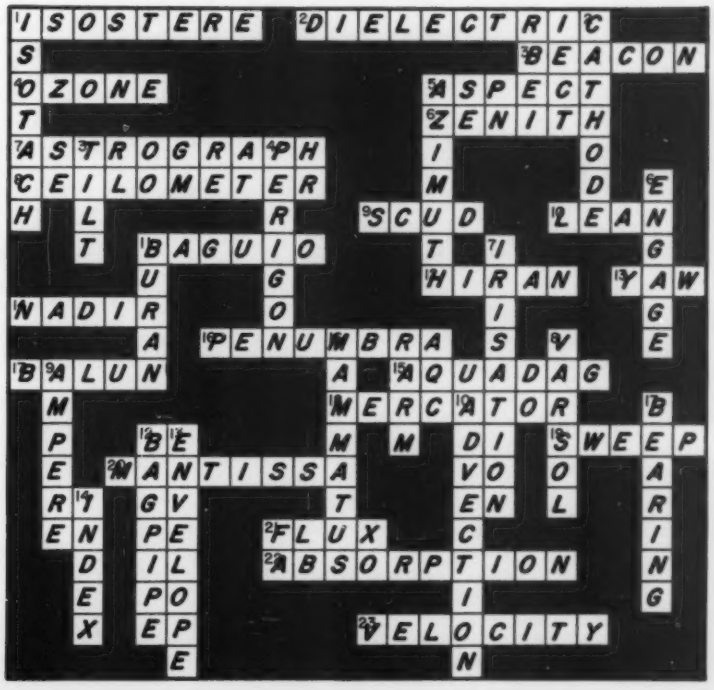
Bomb-Comp'82 tested the new B-52 Offensive Avionics System (OAS). The introduction of the OAS greatly increases the B-52's effectiveness. When reviewing the final results of the '82 competition, one finds a correlation between OAS-equipped aircraft and high scores. The 5th Bomb Wing, Minot AFB, North Dakota, and the 416th Bomb Wing, Griffiss AFB, New York, were the only two units competing with OAS-modified aircraft. Out of 28 crews, the four from Minot and Griffiss placed first, second, fourth and seventh for best B-52 crew. In the General Curtis LeMay Bombing Competition, involving 36 crews, OAS-equipped crews finished second, third, eighth and ninth overall. Vying among fourteen B-52 wings, two FB-111 wings and four RAAF teams, the two OAS-equipped bomb wings finished among the top three in every weapon scoring category. The OAS demonstrated tremendous potential to increase bombing and navigation accuracy and to strengthen SAC's worldwide deterrent role.

Bomb-Comp provides an excellent opportunity for those of us who wear navigator wings to excel. Responsibility for over 90% of the bomber scores and nearly 100% of the tanker scores rests directly on the skills of the navigator, radar navigator, and electronic warfare officer. This friendly competition is SAC's way of showing that we are ready, willing, and able to protect our national interests. That is the bottom line.

A USAF Academy graduate, Capt Christensen completed UNT in 1980 and NBT in 1981. After CCTS, he assumed operational duties at Minot AFB. Capt Christensen now serves as an instructor navigator.

Navwords

Answers to NAVWORDS puzzle from page 25.



Planned TR/OFF	ACTUAL OFFSET (NM) 0	5	10	15	20	25
20/6	19	20	22	24	28	32
20/7	19	19	21	24	27	31
20/8	18	19	21	24	27	31
20/9	18	19	21	23	27	31
20/10	17	18	20	23	26	30
21/7	20	20	22	25	28	32
21/8	19	20	22	25	28	32
21/9	19	20	22	24	28	31
21/10	18	19	21	24	27	31
21/11	18	19	21	23	27	31
22/8	21	21	23	25	29	32
22/9	20	21	23	25	28	32
22/10	20	20	22	25	28	32
22/11	19	20	22	24	28	32
22/12	18	19	21	24	27	31
23/9	21	22	23	26	29	33
23/10	21	21	23	26	29	33
23/11	20	21	23	25	28	32
23/12	20	20	22	25	28	32
24/10	22	22	24	27	30	33
24/11	21	22	24	26	29	33
24/12	21	21	23	26	29	33
24/13	20	21	23	25	28	32
25/12	22	23	24	27	30	33
25/13	21	22	24	26	29	33
26/13	23	23	25	27	30	34
26/14	22	23	24	27	30	33
27/13	24	24	26	28	31	34
27/14	23	24	25	28	31	34
28/15	24	24	26	28	31	34

This chart includes all the turn range/offset possibilities in the 400–480 TAS range as extracted from the KC–135 air refueling manual.

1. Enter chart from left with the planned turn range/offset.

2. Enter from the top with the observed offset as it occurs during the rendezvous.

3. The intersection of these entries is the new turn range (Radar or A/A TACAN) at which to command the tanker's turn.

EXAMPLE: With a planned 20/8 and an actual 20NM offset, the tanker's turn should occur at 27 NM.

NOTE: New turn ranges are rounded to the nearest mile.

Figure 9

You'll find this chart, Fig 9, fits into your checklist. With it you can derive a rendezvous solution in a few seconds. So, the next time you BUFF RNs call ARIP inbound, but quickly find your offset "out to lunch," blame it on the tanker. He'll probably be blaming you. Just remember, it doesn't matter who is at fault—simply save the rendezvous. You'll probably earn the other crew's respect.

In 1976, Capt Dutilly graduated from the University of Texas, El Paso, with a degree in Journalism. He completed UNT and was then assigned to the KC-135 at Kincheloe AFB. Capt Dutilly now serves at Castle AFB.

Don't leave your resource manager without airspeed or ideas. Take time and submit a new AF Form 90 today. Hopefully my remarks will inspire you to "hit the books"—specifically AFP 36-6 and AFR 36-20. You'll be surprised at the exciting opportunities available.

Let's get philosophical for a minute. As you did at the very start of your Air Force duty, you might want to reexamine your objectives at each new career juncture. Career officers must do some periodic self-inspection. Ask yourself, "Why am I wearing the blue suit or green bag?" Remember, first and foremost, you're here to meet the needs of the Air Force. At times, that means taking an assignment that is not at the top of your Form 90. Try to keep your long-range objectives in mind, but always strive to be the best at whatever Air Force job you've got. With that attitude, you just might find that the "squares" get filled surprisingly easily. You'll also reap extra enjoyment from the great career you planned.

Capt Osterheld graduated from the USAF Academy in 1975. After completing UNT, he was assigned to the RF-4 at Shaw AFB, followed by a tour at RAF Alconbury. Capt Osterheld served as an ASTRA RF-4C WSO Career Manager until his present assignment to the SR-71.

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